R309. Environmental Quality, Drinking Water.

R309-515. Facility Design and Operation: Source Development.

R309-515-1. Purpose.

This rule specifies requirements for public drinking water sources. It is intended to be applied in conjunction with R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water that consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

R309-515-2. Authority.

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code Annotated and in accordance with Title 63, Chapter 46a of the same, known as the Administrative Rulemaking Act.

R309-515-3. Definitions.

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

R309-515-4. General.

(1) Issues to be Considered.
The selection, development and operation of a public drinking water source must be done in a manner which will protect public health and assure that all required water quality standards, as described in R309-200, are met.

Guidance: Among the issues which should be considered before source selection and any preparation of development plans are the following:

(a) The source should be analyzed to determine if it would be considered a surface water source or a ground water source. Surface water sources must be given "conventional surface water treatment" to help assure microbiological safety (see R309-525). True groundwater sources ordinarily require only disinfection to help assure microbiological safety (see R309-200-5(7)).

(b) The vulnerability of the source to current and future contamination and how the source will be protected from chemical, radiological or microbial pollution. (see R309-600).

(c) The presence of natural chemical and radiological contaminants may not allow the source to be used as a culinary source. (see MCL's in R309-200).

(d) The source must be able to meet the demands of the system both physically and legally. (see R309-510-7).

(2) Communication with the Division.
Because of the issues described above in (1), engineers are advised to work closely with the Division to help assure that sources are properly sited, developed and operated.

(3) Number of Sources and Quantity Requirements.
Community water systems established after January 1, 1998 serving more than 100 connections shall have a minimum of two sources, except where served by a water treatment plant. Community Water Systems established prior to that date, currently serving more than 100 connections, shall obtain a separate source no later than January 1, 2000. For all systems, the total developed source capacity(ies) shall equal or exceed the peak day demand of the system. Refer to R309-510-7 of these rules for procedure to estimate the peak day demand.

(4) Quality Requirements.
In selecting a source of water for development, the designing engineer shall demonstrate to the satisfaction of the Executive Secretary that the source(s) selected for use in public water systems are of satisfactory quality, or can be treated in a manner so that the quality requirements of R309-200 can be met.

(5) Initial Analyses.
All new drinking water sources, unless otherwise noted below, shall be analyzed for the following:

(a) All the primary and secondary inorganic contaminants listed in R309-200, Table 200-1 and Table 200-5 (excluding Asbestos unless it would be required by R309-205-5(2)),

(b) Ammonia as N; Boron; Calcium; Chromium, Hex as Cr; Copper; Lead; Magnesium; Potassium; Turbidity, as NTU; Specific Conductivity at 25 degrees Celsius, u mhos/cm; Bicarbonate; Carbon Dioxide; Carbonate; Hydroxide; Phosphorous, Ortho as P; Silica, dissolved as SiO_2; Surfactant as MBAS; Total Hardness as $CaCO_3$; and Alkalinity as $CaCO_3$,

(c) Pesticides, PCB's and SOC's as listed in R309-200-5(3)(a), Table 200-2 unless the system is a transient non-community pws or, if a community pws or non-transient non-community pws, they have received waivers in accordance with R309-205-6(1)(f). The following six constituents have been excused from monitoring in the State by the EPA, dibromochloropropane, ethylene dibromide, Diquat, Endothall, glyphosate and Dioxin,

(d) VOC's as listed in R309-200-5(3)(b), Table 200-3 unless the system is a transient non-community pws, and

(e) Radiologic chemicals as listed in R309-200-5(4) unless the system is a non-transient non-community pws or a transient non-community pws.

All analyses shall be performed by a certified laboratory as required by R309-205-4 (Specially prepared sample bottles are required),

(6) Source Classification.
Subsection R309-505-7(1)(a)(i) provides information on the classification of water sources. The Executive Secretary shall classify all existing or new sources as either:

(a) Surface water or ground water under direct influence of surface water which will require conventional surface water treatment or an approved equivalent, or as

(b) Ground water not under the direct influence of surface water.

(7) Latitude and Longitude.
The latitude and longitude, to at least the nearest second, or the location by section, township, range, and course and distance from an established outside section corner or quarter corner of each point of diversion shall be submitted to the Executive Secretary prior to source approval.

R309-515-5. Surface Water Sources.

(1) Definition.
A surface water source, as is defined in R309-110, shall include, but not be limited to tributary systems, drainage basins, natural lakes, artificial reservoirs, impoundments and springs or wells which have been classified as being directly influenced by surface water. Surface water sources will not be considered for culinary use unless they can be rendered acceptable by conventional surface water treatment or other equivalent treatment techniques acceptable to the Executive Secretary.

(2) Pre-design Submittal.
The following information must be submitted to the Executive Secretary and approved in writing before commencement of design of diversion structures and/or water treatment facilities:

(a) A copy of the chemical analyses required by R309-200 and described in R309-515-4(5) above, and

(b) A survey of the watershed tributary to the watercourse along which diversion structures are proposed. The survey shall include, but not be limited to:

(i) determining possible future uses of impoundments or reservoirs,

(ii) the present stream classification by the Division of Water Quality, any obstacles to having stream(s) reclassified 1C, and determining degree of watershed control by owner or other agencies,

(iii) assessing degree of hazard to the supply by accidental spillage of materials that may be toxic, harmful or detrimental to treatment processes,

(iv) obtaining samples over a sufficient period of time to assess the microbiological, physical, chemical and radiological characteristics and variations of the water,

(v) assessing the capability of the proposed treatment process to reduce contaminants to applicable standards, and

(vi) consideration of currents, wind and ice conditions, and the effect of tributary streams at their confluence.

(3) Pre-construction Submittal.
Following approval of a surface water source, the following additional information must be submitted for review and approval prior to commencement of construction:

(a) Evidence that the water system owner has a legal right to divert water from the proposed source for domestic or municipal purposes;

(b) Documentation regarding the minimum firm yield which the watercourse is capable of producing (see R309-515-5(4)(a) below; and

(c) Complete plans and specifications and supporting documentation for the proposed treatment facilities so as to ascertain compliance with R309-525 or R309-530.

(4) Quantity.
The quantity of water from surface sources shall:

(a) Be assumed to be no greater than the low flow of a 25 year recurrence interval or the low flow of record for these sources when 25 years of records are not available;

(b) Meet or exceed the anticipated peak day demand for water as estimated in R309-510-7 and provide a reasonable surplus for anticipated growth; and

(c) Be adequate to compensate for all losses such as silting, evaporation, seepage, and sludge disposal which would be anticipated in the normal operation of the treatment facility.

(5) Diversion Structures.
Design of intake structures shall provide for:

(a) Withdrawal of water from more than one level if quality varies with depth;

(b) Intake of lowest withdrawal elevation located at sufficient depth to be kept submerged at the low water elevation of the reservoir;

(c) Separate facilities for release of less desirable water held in storage;

(d) Occasional cleaning of the inlet line;

(e) A diversion device capable of keeping large quantities of fish or debris from entering an intake structure; and

(f) Suitable protection of pumps where used to transfer diverted water (refer to R309-540-5).

(6) Impoundments.
The design of an impoundment reservoir shall provide for, where applicable:

(a) Removal of brush and trees to the high water level;

(b) Protection from floods during construction;

(c) Abandonment of all wells which may be inundated (refer to applicable requirements of the Division of Water Rights); and

(d) Adequate precautions to limit nutrient loads.

R309-515-6. Ground Water - Wells.

(1) Required Treatment.
If properly developed, water from wells may be suitable for culinary use without treatment. A determination as to whether treatment may be required can only be made after the source has been developed and evaluated.

(2) Standby Power.
Water suppliers, particularly community water suppliers, should assess the capability of their system in the event of a power outage. If gravity fed spring sources are not available, one or more of the system's well sources should be equipped for operation during power outages. In this event:

(a) To ensure continuous service when the primary power has been interrupted, a power supply should be provided through connection to at least two independent public power sources, or portable or in-place auxiliary power available as an alternative; and

(b) When automatic pre-lubrication of pump bearings is necessary, and an auxiliary power supply is provided, the pre-lubrication line should be provided with a valved

by-pass around the automatic control, or the automatic control shall be wired to the emergency power source.

(3) The Utah Division of Water Rights.
The Utah Division of Water Rights (State Engineer's Office) regulates the drilling of water wells. Before the drilling of a well commences, the well driller must receive a start card from the State Engineer's Office.

Guidance: The Administrative Rules for Water Well Drillers, adopted January 1, 2001 should be consulted for additional well drilling information. The engineer and driller should be aware that requirements governing the design of public drinking water wells, as described herein, are generally more strict than requirements of the State Engineer's Office .

(4) Source Protection.
Public drinking water systems are responsible for protecting their sources from contamination. The selection of a well location shall only be made after consideration of the requirements of R309-600. Sources shall be located in an area which will minimize threats from existing or potential sources of pollution.
If certain precautions are taken, sewer lines may be permitted within a public drinking water system's source protection zones at the discretion of the Executive Secretary. When sewer lines are permitted in protection zones both sewer lines and manholes shall be specially constructed as follows:

(a) sewer lines shall be ductile iron pipe with mechanical joints or fusion welded high density polyethylene plastic pipe (solvent welded joints shall not be accepted);

(b) lateral to main connection shall be shop fabricated or saddled with a mechanical clamping watertight device designed for the specific pipe;

(c) the sewer pipe to manhole connections shall made using a shop fabricated sewer pipe seal ring cast into the manhole base (a mechanical joint shall be installed within 12 inches of the manhole base on each line entering the manhole, regardless of the pipe material);

(d) the sewer pipe shall be laid with no greater than 2 percent deflection at any joint;

(e) backfill shall be compacted to not less than 95 percent of maximum laboratory density as determined in accordance with ASTM Standard D-690;

(f) sewer manholes shall meet the following requirements:

(i) the manhole base and walls, up to a point at least 12 inches above the top of the upper most sewer pipe entering the manhole, shall be shop fabricated in a single concrete pour.

(ii) the manholes shall be constructed of reinforced concrete.

(iii) all sewer lines and manholes shall be air pressure tested after installation.

(5) Outline of Well Approval Process.

(a) Well drilling shall not commence until both of the following items are submitted and receive a favorable review:

(i) a Preliminary Evaluation Report on source protection issues as required by R309-600-13, and

(ii) engineering plans and specifications governing the well drilling, prepared by a licensed well driller holding a current Utah Well Drillers Permit if previously authorized by the Executive Secretary or prepared, signed and stamped by a licensed professional engineer or professional geologist licensed to practice in Utah.

(b) Grouting Inspection During Well Construction.
An engineer from the Division, or the appropriate district engineer of the Department of Environmental Quality, an authorized representative of the State Engineer's Office, or an individual authorized by the Executive Secretary shall be contacted at least three days before the anticipated beginning of the well grouting procedure (see R309-515-6(6)(i)). The well grouting procedure shall be witnessed by one of these individuals or their designee.

(c) After completion of the well drilling the following information shall be submitted and receive a favorable review before water from the well can be introduced into a public water system:

(i) a copy of the "Report of Well Driller" as required by the State Engineer's Office which is complete in all aspects and has been stamped as received by the same;

(ii) a copy of the letter from the authorized individual described in R309-515-6(5)(b) above, indicating inspection and confirmation that the well was grouted in accordance with the well drilling specifications and the requirements of this rule;

(iii) a copy of the pump test including the yield vs. drawdown test as described in R309-515-6(10)(b) along with comments / interpretation by a licensed professional engineer or licensed professional geologist of the graphic drawdown information required by R309-515-6(b)(vi)(E);

(iv) a copy of the chemical analyses required by R309-515-4(5);

Guidance: In order for the levels of analytes to be representative of the aquifer and

reduce the chance that turbidity will exceed the ground water limit, the samples for the analysis should be collected after the well has been fully developed and continuously pumped for 24 hours.

(v) documentation indicating that the water system owner has a right to divert water for domestic or municipal purposes from the well source;

(vi) a copy of complete plans and specifications prepared, signed and stamped by a licensed professional engineer covering the well housing, equipment and diversion piping necessary to introduce water from the well into the distribution system; and

(vii) a bacteriological analysis of water obtained from the well after installation of permanent equipment, disinfection and flushing.

(d) An Operation Permit shall be obtained in accordance with R309-500-9 before any water from the well is introduced into a public water system.

(6) Well Materials, Design and Construction.

(a) ANSI/NSF Standards 60 and 61 Certification.
All interior surfaces must consist of products complying with ANSI/NSF Standard 61. This requirement applies to drop pipes, well screens, coatings, adhesives, solders, fluxes, pumps, switches, electrical wire, sensors, and all other equipment or surfaces which may contact the drinking water.

All substances introduced into the well during construction or development shall be certified to comply with ANSI/NSF Standard 60. This requirement applies to drilling fluids (biocides, clay thinners, defoamers, foamers, loss circulation materials, lubricants, oxygen scavengers, viscosifiers, weighting agents) and regenerants. This requirement also applies to well grouting and sealing materials which may come in direct contact with the drinking water.

(b) Permanent Steel Casing Pipe shall:

(i) be new single steel casing pipe meeting AWWA Standard A-100, ASTM or API specifications and having a minimum weight and thickness as given in Table 1 found in R655-4-9.4 of the Utah Administrative Code (Administrative Rules for Water Well Drillers, adopted January 1, 2001, Division of Water Rights);

(ii) have additional thickness and weight if minimum thickness is not considered sufficient to assure reasonable life expectancy of the well;

(iii) be capable of withstanding forces to which it is subjected;

(iv) be equipped with a drive shoe when driven;

(v) have full circumferential welds or threaded coupling joints; and

(vi) project at least 18 inches above the anticipated final ground surface and at least 12 inches above the anticipated pump house floor level. At sites subject to flooding the top of the well casing shall terminate at least three feet above the 100 year flood level or the highest known flood elevation, whichever is higher.

(c) Non-Ferrous Casing Material.

The use of any non-ferrous material for a well casing shall receive prior approval of the Executive Secretary based on the ability of the material to perform its desired function. Thermoplastic water well casing pipe shall meet ANSI/ASTM Standard F480-76 and shall bear the logo NSF-wc indicating compliance with NSF Standard 14 for use as well casing.

(d) Disposal of Cuttings.

Cuttings and waste from well drilling operations shall not be discharged into a waterway, lake or reservoir. The rules of the Utah Division of Water Quality must be observed with respect to these discharges.

(e) Packers.

Packers, if used, shall be of material that will not impart taste, odor, toxic substances or bacterial contamination to the well water. Lead, or partial lead packers are specifically prohibited.

(f) Screens.

The use of well screens is recommended where appropriate and, if used, they shall:

(i) be constructed of material resistant to damage by chemical action of groundwater or cleaning operations;

(ii) have size of openings based on sieve analysis of formations or gravel pack materials;

(iii) have sufficient diameter to provide adequate specific capacity and low aperture entrance velocities;

Guidance: Usually the entrance velocities should not exceed 0.1 fps.

(iv) be installed so that the operating water level remains above the screen under all pumping conditions; and

(v) be provided with a bottom plate or washdown bottom fitting of the same material as the screen.

(g) Plumbness and Alignment Requirements.

Every well shall be tested for plumbness and vertical alignment in accordance with AWWA Standard A100. Plans and specifications submitted for review shall:

(i) have the test method and allowable tolerances clearly stated in the specifications. and

(ii) clearly indicate any options the design engineer may have if the well fails to meet the requirements. Generally wells may be accepted if the misalignment does not interfere with the installation or operation of the pump or uniform placement of grout.

(h) Casing Perforations.
The placement of perforations in the well casing shall:

(i) be so located to permit as far as practical the uniform collection of water around the circumference of the well casing, and

(ii) be of dimensions and size to restrain the water bearing soils from entrance into the well.

(i) Grouting Techniques and Requirements.
All permanent well casing for public drinking water wells shall be grouted to a depth of at least 100 feet below the ground surface unless an "exception" is issued by the Executive Secretary (see R309-500-4(1)).

Guidance: This is required in order to prevent the seepage of undesirable surface or shallow ground water along the casing into the water bearing aquifer.

If a well is to be considered in a protected aquifer the grout seal shall extend from the ground surface down to at least 100 feet below the surface, and through the protective layer, as described in R309-600-6(1)(v) (see also R309-151-6(6)(i)(iii)(D) below).

The following applies to all drinking water wells:

(i) Consideration During Well Construction.

(A) Sufficient annular opening shall be provided to permit a minimum of two inches of grout between the permanent casing and the drilled hole, taking into consideration any joint couplings. If a carrier casing is left in place, the minimum clearances above shall pertain to both annular openings (between casings and between carrier casing and the drilled hole), the carrier casing shall be adequately perforated so as to ensure grout contact with the native formations, and the carrier casing shall be withdrawn at least five feet during grouting operations.

Guidance: For the purpose of determining the dimension of the annular opening between the drilled hole and or any carrier casing or permanent casing which may be used, the nominal pipe dimension of casing or hole can be used.

(B) Additional information is available from the Division for recommended construction methods for grout placement.

(C) The casing(s) must be provided with sufficient guides welded to the casing to permit unobstructed flow and uniform thickness of grout.

(ii) Grouting Materials.

(A) Neat Cement Grout.
Cement, conforming to ASTM Standard C150, and water, with no more than six gallons of water per sack of cement, shall be used for two inch openings. Additives may be used to increase fluidity subject to approval by the Executive Secretary.

(B) Concrete Grout.
Equal parts of cement conforming to ASTM Standard C150, and sand, with not more than six gallons of water per sack of cement may be used for openings larger than two inches.

(C) Clay Seal.
Where an annular opening greater than six inches is available a clay seal of clean local clay mixed with at least ten percent swelling bentonite may be used when approved by the Executive Secretary.

(iii) Application.

(A) When the annular opening is less than four inches, grout shall be installed under pressure, by means of a positive displacement grout pump, from the bottom of the annular opening to be filled.

(B) When the annular opening is four or more inches and 100 feet or less in depth, and concrete grout is used, it may be placed by gravity through a grout pipe installed to the bottom of the annular opening in one continuous operation until the annular opening is filled.

(C) All temporary construction casings should be removed but shall be withdrawn at least five feet during the grouting operation to ensure grout contact with the native formations.

(D) When a "well in a protected aquifer" classification is desired, the grout seal shall extend from the ground surface down to at least 100 feet below the surface, and through the protective clay layer (see R309-600-6(1)(v)). If the clay layer starts below 100 feet, grout shall extend from the ground surface to a depth of at least 100 feet, grout or native fill may be utilized from there to the top of the clay layer, and then grout placed completely through the protective clay layer. If the clay layer starts and ends above 100 feet, grout shall extend from the ground surface down to and completely through the protective clay layer.

(E) After cement grouting is applied, work on the well shall be discontinued until the cement or concrete grout has properly set; usually a period of 72 hours.

(j) Water Entered Into Well During Construction.
Any water entering a well during construction shall not be contaminated and should be obtained from a chlorinated municipal system. Where this is not possible the water must be dosed to give a 100 mg/l free chlorine residual. Refer also to the administrative rules of the Division of Water Rights in this regard.

(k) Gravel Pack Wells.
The following shall apply to gravel packed wells:

(i) the gravel pack material is to be of well rounded particles, 95 percent siliceous material, that are smooth and uniform, free of foreign material, properly sized, washed and then disinfected immediately prior to or during placement,

(ii) the gravel pack is placed in one uniform continuous operation,

(iii) refill pipes, when used, are Schedule 40 steel pipe incorporated within the pump foundation and terminated with screwed or welded caps at least 12 inches above the pump house floor or concrete apron,

(iv) refill pipes located in the grouted annular opening be surrounded by a minimum of 1.5 inches of grout,

(v) protection provided to prevent leakage of grout into the gravel pack or screen, and

(vi) any casings not withdrawn entirely meet requirements of R309-515-6(6)(b) or R309-515-6(6)(c).

(7) Well Development.

(a) Every well shall be developed to remove the native silts and clays, drilling mud or finer fraction of the gravel pack.

(b) Development should continue until the maximum specific capacity is obtained from the completed well.

(c) Where chemical conditioning is required, the specifications shall include provisions for the method, equipment, chemicals, testing for residual chemicals, and disposal of waste and inhibitors.

(d) Where blasting procedures may be used the specifications shall include the provisions for blasting and cleaning. Special attention shall be given to assure that the grouting and casing are not damaged by the blasting.

(8) Capping Requirements.

(a) A welded metal plate or a threaded cap is the preferred method for capping a completed well until permanent equipment is installed.

(b) At all times during the progress of work the contractor shall provide protection to prevent tampering with the well or entrance of foreign materials.

(9) Well Abandonment.

(a) Test wells and groundwater sources which are to be permanently abandoned shall be sealed by such methods as necessary to restore the controlling geological conditions which existed prior to construction or as directed by the Utah Division of Water Rights.

(b) Wells to be abandoned shall be sealed to prevent undesirable exchange of water from one aquifer to another. Prefernce shall be given to using a neat cement grout. Where fill materials are used, which are other than cement grout or concrete, they shall be disinfected and free of foreign materials. When an abandoned will is filled with cement- grout or concrete, these materials shall be applied to the well- hole through a pipe, tremie, or bailer.

(10) Well Assessment.

(a) Step Drawdown Test.
Preliminary to the constant-rate test required below, it is recommended that a step-drawdown test (uniform increases in pumping rates over uniform time intervals with single drawdown measurements taken at the end of the intervals) be conducted to determine the maximum pumping rate for the desired intake setting.

(b) Constant-Rate Test.
A "constant-rate" yield and drawdown test shall:

(i) be performed on every production well after construction or subsequent treatment and prior to placement of the permanent pump,

(ii) have the test methods clearly indicated in the specifications,

(iii) have a test pump with sufficient capacity that when pumped against the maximum anticipated drawdown, it will be capable of pumping in excess of the desired design discharge rate,

(iv) provide for continuous pumping for at least 24 hours or until stabilized drawdown has continued for at least six hours when test pumped at a "constant-rate" equal to the desired design discharge rate,

(v) provide the following data:

(A) capacity vs. head characteristics for the test pump (manufacturer's pump curve),

(B) static water level (in feet to the nearest tenth, as measured from an identified datum; usually the top of casing),

(C) depth of test pump intake,

(D) time and date of starting and ending test(s),

Guidance: It is recommended to monitor any existing wells in the area during the pump test to perform a more useful aquifer test and determine if there will be interference from other wells.

(vi) For the "constant-rate" test provide the following at time intervals sufficient for at least ten essentially uniform intervals for each log cycle of the graphic evaluation required below:

(A) record the time since starting test (in minutes),

(B) record the actual pumping rate,

(C) record the pumping water level (in feet to the nearest tenth, as measured from the same datum used for the static water level),

(D) record the drawdown (pumping water level minus static water level in feet to the nearest tenth),

(E) provide graphic evaluation on semi-logarithmic graph paper by plotting the drawdown measurements on the arithmetic scale at

locations corresponding to time since starting test on the logarithmic scale, and

(vii) Immediately after termination of the constant-rate test, and for a period of time until there are no changes in depth to water level measurements for at least six hours, record the following at time intervals similar to those used during the constant-rate pump test:

(A) time since stopping pump test (in minutes),

(B) depth to water level (in feet to the nearest tenth, as measured from the same datum used for the pumping water level).

(11) Well Disinfection.
Every new, modified, or reconditioned well including pumping equipment shall be disinfected before being placed into service for drinking water use. These shall be disinfected according to AWWA Standard C654 published by the American Water Works Association as modified to incorporate the following as a minimum standard:

(i) the well shall be disinfected with a chlorine solution of sufficient volume and strength and so applied that a concentration of at least 50 parts per million is obtained in all parts of the well and comes in contact with equipment installed in the well. This solution shall remain in the well for a period of at least eight hours, and

(ii) a satisfactory bacteriologic water sample analysis shall be obtained prior to the use of water from the well in a public water system.

(12) Well Equipping.

(a) Naturally Flowing Wells.
Naturally flowing wells shall:

(i) have the discharge controlled by valves,

(ii) be provided with permanent casing and sealed by grout,

(iii) if erosion of the confining bed adjacent to the well appears likely, special protective construction may be required by the Division.

(b) Line Shaft Pumps.
Wells equipped with line shaft pumps shall:

(i) have the casing firmly connected to the pump structure or have the casing inserted into the recess extending at least 0.5 inches into the pump base,

(ii) have the pump foundation and base designed to prevent fluids from coming into contact with joints between the pump base and the casing,

(iii) be designed such that the intake of the well pump is at least ten feet below the maximum anticipated drawdown elevation,

(iv) avoid the use of oil lubrication for pumps with intake screens set at depths less than 400 feet (see R309-105-10(7) and/or R309-515-8(2)for additional requirements of lubricants).

(c) Submersible Pumps.
Where a submersible pump is used:

(i) The top of the casing shall be effectively sealed against the entrance of water under all conditions of vibration or movement of conductors or cables.

(ii) The electrical cable shall be firmly attached to the riser pipe at 20 foot intervals or less.

(iv) The intake of the well pump must be at least ten feet below the maximum anticipated drawdown elevation.

(d) Pitless Well Units and Adapters.
Pitless well units and adapters shall:

(i) not be used unless the specific application has been approved by the Executive Secretary,

(ii) terminate at least 18 inches above final ground elevation or three feet above the highest known flood elevation whichever is greater,

(iii) be approved by NSF International or the Pitless Adapter Association or other appropriate Review Authority,

(iv) have suitable access to the interior of the casing in order to disinfect the well,

(v) have a suitable sanitary seal or cover at the upper terminal of the casing that will prevent the entrance of any fluids or contamination, especially at the connection point of the electrical cables,

(vi) have suitable access so that measurements of static and pumped water levels in the well can be obtained,

(vii) allow at least one check valve within the well casing,

(viii) be furnished with a cover that is lockable or otherwise protected against vandalism or sabotage,

(ix) be shop-fabricated from the point of connection with the well casing to the unit cap or cover,

(x) be of watertight construction throughout,

(xi) be constructed of materials at least equivalent to and having wall thickness compatible to the casing,

(xii) have field connection to the lateral discharge from the pitless unit of threaded, flanged or mechanical joint connection,

(xiii) be threaded or welded to the well casing. If the connection to the casing is by field weld, the shop assembled unit must be designed specifically for field welding to the casing. The only field welding permitted on the pitless unit will be that needed to connect a pitless unit to the casing, and

(xiv) have an inside diameter as great as that of the well casing, up to and including casing diameters of 12 inches, to facilitate work and repair on the well, pump, or well screen.

(e) Well Discharge Piping.
The discharge piping shall:

(i) be designed so that the friction loss will be low,
(ii) have control valves and appurtenances located above the pump house floor when an above-ground discharge is provided,

(iii) be protected against the entrance of contamination,

(iv) be equipped with (in order of placement from the well head) a smooth nosed sampling tap, a check valve, a pressure gauge, a means of measuring flow and a shutoff valve,

(v) where a well pumps directly into a distribution system, be equipped with an air release vacuum relief valve located upstream from the check valve, with exhaust/relief piping terminating in a down-turned position at least six inches above the floor and covered with a No. 14 mesh corrosion resistant screen. An exception to this requirement will be allowed provided specific proposed well head valve and piping design includes provisions for pumping to waste all trapped air before water is introduced into the distribution system,

(vi) have all exposed piping valves and appurtenances protected against physical damage and freezing,

(vii) be properly anchored to prevent movement, and

Guidance: The discharge piping should be provided with a means of pumping to waste, but shall not be connected to a sewer/storm drain without an air gap. The discharge end of the pump-to-waste line shall be covered with No. 4 mesh corrosion resistant screen (refer to R309-545-10(1)).

Guidance: Provisions should be made for venting the well casing to atmosphere, particularly if a large or sudden water drawdown is expected. The vent shall terminate in a down turned position, at or above the top of the casing or pitless unit in a minimum 1.5 inch diameter opening covered with a No. 14 mesh, corrosion resistant screen (refer to section R309-545-15). The pipe connecting the casing to the vent shall be of adequate size to provide rapid venting of the casing.

(f) Water Level Measurement.

(i) Provisions shall be made to permit periodic measurement of water levels in the completed well.

(ii) Where permanent water level measuring equipment is installed it shall be made using corrosion resistant materials attached firmly to the drop pipe or pump column and installed in such a manner as to prevent entrance of foreign materials.

(g) Observation Wells.
Observation wells shall be:

(i) constructed in accordance with the requirements for permanent wells if they are to remain in service after completion of a water supply well, and

(ii) protected at the upper terminal to preclude entrance of foreign materials.

(h) Electrical Protection.
Sufficient electrical controls shall be placed on all pump motors to eliminate electrical problems due to phase shifts, surges, lightning, etc.

(13) Well House Construction.
The use of a well house is strongly recommended, particularly in installations utilizing above ground motors.

In addition to applicable provisions of R309-540, well pump houses shall conform to the following:

(a) Casing Projection Above Floor.

The permanent casing for all ground water wells shall project at least 12 inches above the pump house floor or concrete apron surface and at least 18 inches above the final ground surface. However, casings terminated in underground vaults may be permitted if the vault is provided with a drain to daylight sized to handle in excess of the well flow and surface runoff is directed away from the vault access.

(b) Floor Drain.
Where a well house is constructed the floor surface shall be at least six inches above the final ground elevation and shall be sloped to provide drainage. A "drain-to-daylight" shall be provided unless highly impractical.

(c) Earth Berm.
Sites subject to flooding shall be provided with an earth berm terminating at an elevation at least two feet above the highest known flood elevation or other suitable protection as determined by the Executive Secretary.

(d) Well Casing Termination at Flood Sites.
The top of the well casing at sites subject to flooding shall terminate at least 3 feet above the 100 year flood level or the highest known flood elevation, whichever is higher (refer to R309-515-6(6)(b)(vi)).

(e) Miscellaneous.
The well house shall be ventilated, heated and lighted in such a manner as to assure adequate protection of the equipment (refer to R309-540-5(2) (a) through (h)

(f) Fencing.
Where necessary to protect the quality of the well water the Executive Secretary may require that certain wells be fenced in a manner similar to fencing required around spring areas.

(g) Access.
An access shall be provided either through the well house roof or sidewalls in the event the pump must be pulled for replacement or servicing the well.

R309-515-7. Ground Water - Springs.

(1) General.
Springs vary greatly in their characteristics and they should be observed for some time prior to development to determine any flow and quality variations. Springs determined to be "under the direct influence of surface water" will have to be given "surface water treatment".

(2) Source Protection.
Public drinking water systems are responsible for protecting their spring sources from contamination. The selection of a spring should only be made after consideration of the requirements of R309-515-4. Springs must be located in an area which shall minimize

threats from existing or potential sources of pollution. A Preliminary Evaluation Report on source protection issues is required by R309-600-13(2). If certain precautions are taken, sewer lines may be permitted within a public drinking water system's source protection zones at the discretion of the Executive Secretary. When sewer lines are permitted in protection zones both sewer lines and manholes shall be specially constructed as described in R309-515-6(4).

(3) Surface Water Influence.
Some springs yield water which has been filtered underground for years, other springs yield water which has been filtered underground only a matter of hours. Even with proper development, the untreated water from certain springs may exhibit turbidity and high coliform counts. This indicates that the spring water is not being sufficiently filtered in underground travel. If a spring is determined to be "under the direct influence of surface water", it shall be given "conventional surface water treatment" (refer to R309-505-6).

(4) Pre-construction Submittal
Before commencement of construction of spring development improvements the following information must be submitted to the Executive Secretary and approved in writing.

(a) Detailed plans and specifications covering the development work.

(b) A copy of an engineer's or geologist's statement indicating:

(i) the historical record (if available) of spring flow variation,

(ii) expected minimum flow and the time of year it will occur,

(iii) expected maximum flow and the time of year it will occur,

(iv) expected average flow,

(v) the behavior of the spring during drought conditions.

After evaluating this information, the Division will assign a "firm yield" for the spring which will be used in assessing the number of and type of connections which can be served by the spring (see "desired design discharge rate" in R309-110).

(c) A copy of documentation indicating the water system owner has a right to divert water for domestic or municipal purposes from the spring source.

(d) A Preliminary Evaluation Report on source protection issues as required by R309-600-13.

Guidance: The public water system management and the design engineer should refer to R309-505-7(1), especially the frequent monitoring described in subsection (a)(ii), before considering a spring as a source for a public water system.

(e) A copy of the chemical analyses required by R309-515-4(5).

(f) An assessment of whether the spring is "under the direct influence of surface water" (refer to R309-505-7(1)(a).

(5) Information Required after Spring Development.
After development of a culinary spring, the following information shall be submitted:

(a) Proof of satisfactory bacteriologic quality.

(b) Information on the rate of flow developed from the spring.

(c) As-built plans of spring development.

(6) Operation Permit Required.
Water from the spring can be introduced into a public water system only after it has been approved for use, in writing, by the Executive Secretary (see R309-500-9).

(7) Spring Development.
The development of springs for drinking water purposes shall comply with the following requirements:

(a) The spring collection device, whether it be collection tile, perforated pipe, imported gravel, infiltration boxes or tunnels must be covered with a minimum of ten feet of relatively impervious soil cover. Such cover must extend a minimum of 15 feet in all horizontal directions from the spring collection device. Clean, inert, non-organic material shall be placed in the vicinity of the collection device(s).

(b) Where it is impossible to achieve the ten feet of relatively impervious soil cover, an acceptable alternate will be the use of an impermeable liner provided that:

(i) the liner has a minimum thickness of at least 10 mils,

(ii) all seams in the liner are folded or welded to prevent leakage,

(iii) the liner is certified as complying with ANSI/NSF Standard 61. This requirement is waived if certain that the drinking water will not contact the liner,

(iv) the liner is installed in such a manner as to assure its integrity. No stones, two inch or larger or sharp edged, shall be located within two inches of the liner,

(v) a minimum of two feet of relatively impervious soil cover is placed over the impermeable liner,

(vi) the soil and liner cover are extended a minimum of 15 feet in all horizontal directions from the collection devices.

(c) Each spring collection area shall be provided with at least one collection box to permit spring inspection and testing.

(d) All junction boxes and collection boxes, must comply with R309-545 with respect to access openings, venting, and tank overflow. Lids for these spring boxes shall be gasketed and the box adequately vented.

(e) The spring collection area shall be surrounded by a fence located a distance of 50 feet (preferably 100 feet if conditions allow) from all collection devices on land at an elevation equal to or higher than the collection device, and a distance of 15 feet from all collection devices on land at an elevation lower than the collection device. The elevation datum to be used is the surface elevation at the point of collection. The fence shall be at least "stock tight" (see R309-110). In remote areas where no grazing or public access is possible, the fencing requirement may be waived by the Executive Secretary. In populated areas a six foot high chain link fence with three strands of barbed wire may be required.

(f) Within the fenced area all vegetation which has a deep root system shall be removed.

(g) A diversion channel, or berm, capable of diverting all anticipated surface water runoff away from the spring collection area shall be constructed immediately inside the fenced area.

(h) A permanent flow measuring device shall be installed. Flow measurement devices such as critical depth meters or weirs shall be properly housed and otherwise protected.

(i) The spring shall be developed as thoroughly as possible so as to minimize the possibility of excess spring water ponding within the collection area. Where the ponding of spring water is unavoidable, the excess shall be collected by shallow piping or french drain and be routed beyond and down grade of the fenced area required above, whether or not a fence is in place.

R309-515-8. Operation and Maintenance.

(1) Spring Collection Area Maintenance.

(a) Spring collection areas shall be periodically (preferably annually) cleared of deep rooted vegetation to prevent root growth from clogging collection lines. Frequent hand or mechanical clearing of spring collection areas and diversion channel is strongly recommended. It is advantageous to encourage the growth of grasses and

other shallow rooted vegetation for erosion control and to inhibit the growth of more detrimental flora.

(b) No pesticide (e.g., herbicide) may be applied on a spring collection area without the prior written approval of the Executive Secretary. Such approval shall be given 1) only when acceptable pesticides are proposed; 2) when the pesticide product manufacturer certifies that no harmful substance will be imparted to the water; and 3) only when spring development construction meets the requirements of these rules.

(2) Pump Lubricants.

The U.S. Food and Drug Administration (FDA) has approved propylene glycol and certain types of mineral oil for occasional contact with or for addition to food products. These oils are commonly referred to as "food-grade mineral oils". All oil lubricated pumps shall utilize food grade mineral oil suitable for human consumption as determined by the Executive Secretary.

Guidance: To assure proper performance, and to prevent the voiding of any warranties which may be in force, the water supplier should confirm with individual pump manufacturers that the oil which is selected will have the necessary properties to perform satisfactorily.

(3) Algicide Treatment.

No algicide shall be applied to a drinking water source unless specific approval is obtained from the Division. Such approval will be given only if the algicide is certified as meeting the requirements of ANSI/NSF Standard 60, Water Treatment Chemicals - Health Effects.

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